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GB 2272774 A GB 2073287 A

(58) Field of Search
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(54) Well tubing valve

(57) A pressure flow valve (1) for controlling fluid flow in well tubing comprises a tubular body (2) provided with at least one flow port (3); fluid control means in the form of sleeve (4) moveable relative to the tubular body (1) from a first position in which fluid can flow into the tubular body via the flow port, to a second position in which the control means seals the flow port; biasing means in the form of spring (5) and chamber (6) for moving the fluid flow control means towards the first position when the fluid pressure differential between fluid present in the tubular body and fluid outside the tubular body is negative, and moving the control means towards the second position when the pressure differential is positive; and locking means (7) connected to the control means for retaining the control means in the second position once the flow port (3) has been closed.

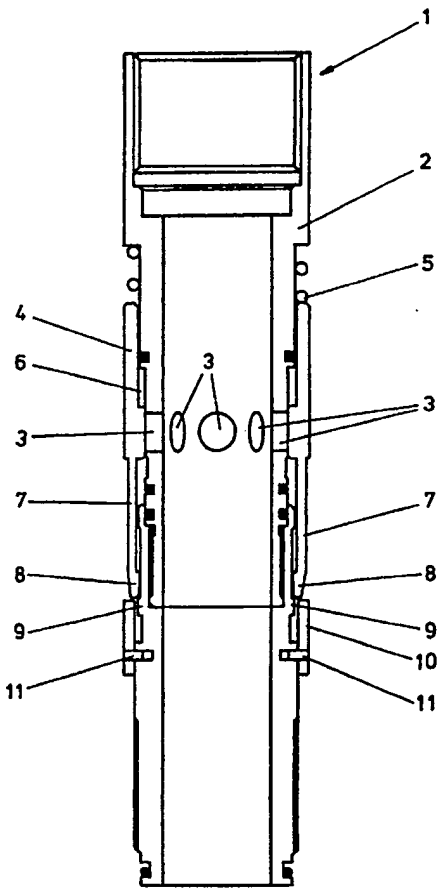

FIG. 1

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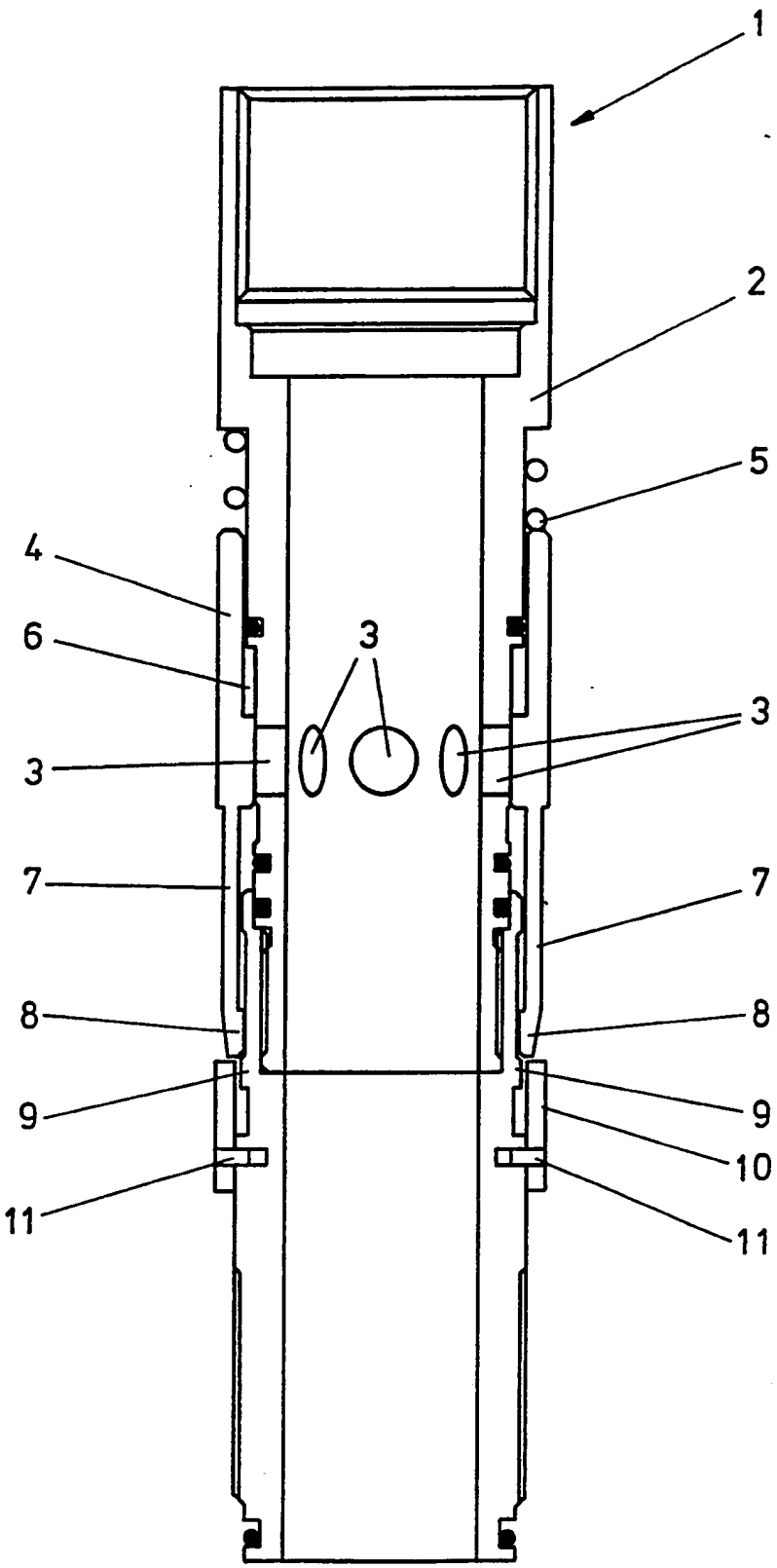

FIG. 1

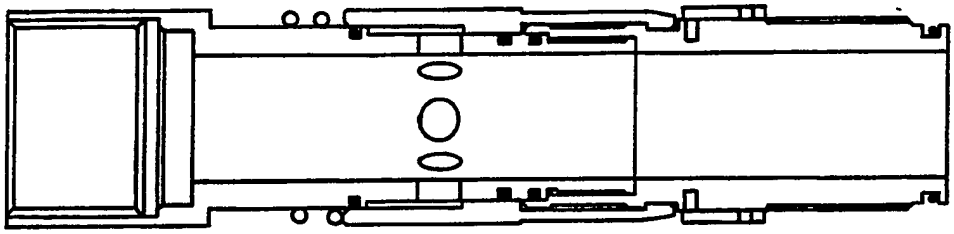

FIG. 4

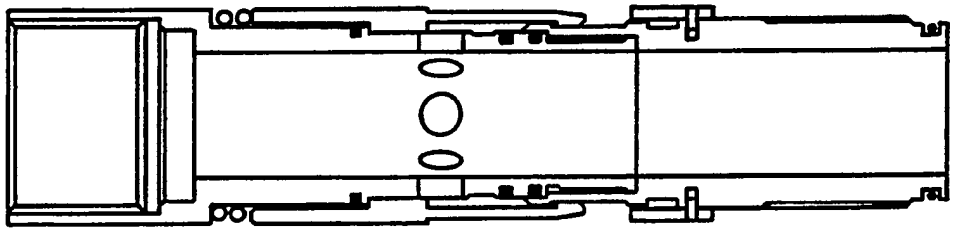

FIG. 3

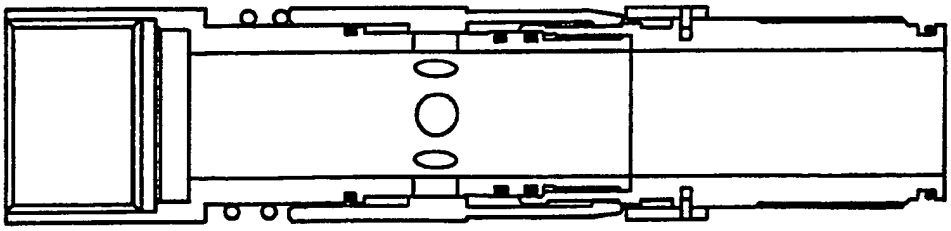

FIG. 2

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PRESSURE FLOW VALVE

This invention relates to a pressure flow valve of the type suitable for use in controlling fluid flow in tubing of an oil or gas production installation. The valve of the invention is particularly, though not exclusively, of the type which is actuated by fluid pressure.

In the extraction of fluids from underground reservoirs a bore or well is drilled to the underground reservoir. The drilled bore or well is usually lined with a metal casing which is secured in place by injecting cement between the casing and the surrounding rock formation. This bonds the casing in place and helps to reinforce the rock which may have cracked or be partially shattered. Production tubing, through which well fluids flow to the surface, is then fed into the casing. These well fluids may contain oil, gas, water, or a mixture of these fluids. The production tubing is the primary method of controlling the pressure of rising well fluids. Therefore, it is essential that the production tubing installed in the well is capable of withstanding a known pressure limit. The production tubing is tested to ensure that it has been installed correctly and that the tubing will not fail once extraction of hydrocarbon fluids has started.

The normal procedure for installing the production tubing is to run the tube into the casing and permit fluid to enter the tube. This prevents the tube from floating and makes installation into the metal casing easier. Once the tube has been placed in the metal casing to the required depth a plug is run into the tubing using downhole wireline techniques. The plug is used to seal the production tubing so that the tubing can be pressure tested. However, this operation is time consuming and there is a risk that the wireline tool or plug will become stuck before reaching the end of the tubing. Trying to remove or recover a stuck tool can be difficult and results in further loss of production time.

The pressure flow valve of the present invention attempts to

overcome these disadvantages associated with known tools and techniques by providing a valve in situ which can be operated remotely by pressurising fluid in the production tubing.

According to the invention there is provided a pressure flow valve for controlling fluid flow in tubing which comprises:

a tubular body provided with at least one flow port;

fluid control means moveable relative to the tubular body from a first position in which fluid can flow into the tubular body via the flow port, to a second position in which the control means seals the flow port;

biasing means for moving the fluid flow control means towards the first position when the fluid pressure differential between fluid present in the tubular body and fluid outside the tubular body is negative, and moving the control means towards the second position when the pressure differential is positive; and

locking means connected to the control means for retaining the control means in the second position once the flow port has been closed.

The pressure control valve of the invention has the advantage that it is fitted to the end of the production tubing before it is run into the well. The valve permits the tubing to fill with fluid as the tubing is run into the well hole because of the difference in pressure between fluid in the tube and fluid in the metal casing. Once installed the production tubing can be pressure tested by increasing the pressure of the fluid in the tubing. This automatically causes the control means to move to the second position and seal the flow port. Therefore, the valve of the invention has the further advantage that use of a wire line tool is eliminated and the risk of losing production time is substantially reduced. Furthermore, the pressure testing stage of the installation procedure can be conducted much more quickly and easily.

The fluid flow control means may comprise a sleeve slidable

relative to the tubular body between the first and second positions. The sleeve seals the fluid flow port when the pressure inside the tubing is greater than the pressure in the annular space between the metal casing and the tubing (the "annulus").

The biasing means may comprise a resilient member and a pressure chamber, said pressure chamber being located intermediate of the control means and the external surface of the tubular member; wherein a negative pressure differential causes a reduction in the volume of said chamber and movement of the control means towards its first position, and the resilient member urges the control means towards its second position when the pressure differential is positive. The biasing means determines how the flow valve reacts to the pressure differential between fluid in the production tubing and fluid in the annulus. Operators on the surface can activate the valve by pressurising fluid present in the production tubing.

The resilient member is preferably a spring and acts directly on the sleeve.

Preferably, the locking means comprises a plurality of fingers extending from the sleeve, said fingers being engageable with one or more protrusions on the tubular body. The fingers do not interfere with flow of fluid into or out of the flow ports.

Alternatively, the locking means comprises a plurality of fingers extending from the sleeve, said fingers being engageable with one or more recesses provided in the tubular body.

Generally, the locking means further includes one or more shear pins which only permit locking of the control means once a the pressure inside the tubular body reaches a predetermined value. This construction of valve has the advantage that it is not

susceptible to being triggered accidentally or by small variations in fluid pressure in the production tubing or the annulus.

The shear pins may be housed in a ring upon which the ends of the fingers abut to lock the control means. Use of a ring eliminates the need to maintain precise alignment between the fingers and the shear pins. Furthermore, a plurality of shear pins provides a more precise and accurate resisting pressure thereby producing a more reliable valve operation.

Preferably, the locking means is releasable. Releasable locking means has the advantage that the valve can be reset without using a further down hole tool or removing the production tubing from the well.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view of a pressure flow valve according to the invention;

Figure 2 is a cross-sectional view of a pressure control valve shown in a neutral position;

Figure 3 is a further cross-sectional view of the flow valve shown in Figure 1 with the flow port open; and,

Figure 4 is a further cross-sectional view of the flow valve shown in Figure 1 with the flow port closed.

Referring to the drawings, Figure 1 is a cross-sectional view of a flow valve according to the invention, generally indicated by reference numeral 1. The pressure flow valve comprises a tubular body 2 provided with eight flow ports 3 through which fluids from the annulus (not shown) may flow. Fluid control

means is provided in the form of a sleeve 4 which is moveable relative to the tubular body 2 from a first position, in which fluid is permitted to flow into the tubular body via the flow ports 3, to a second position in which the sleeve 4 seals the flow ports 3. The spring 5 and annular chamber 6 bias the sleeve according to whether the pressure differential between the fluid in the tubular body 2 and fluid in the annulus is positive or negative. The pressure differential is negative when the pressure of the fluid in the annulus is greater than the pressure of the fluid in the tubular body. The pressure reduces the volume of the chamber 6 and compresses the spring 5 thereby moving the sleeve to its first position in which the flow ports 3 are opened.

Locking means retain the sleeve 4 in the second position once the flow ports 3 have been sealed. The locking means comprises four fingers 7 which extend downwardly from the sleeve 4. The fingers permit uninterrupted flow of fluid into the production tubing. The ends of the fingers 7 are provided with barbs 8 which engage with corresponding protrusions 9 on the tubular body 2 to lock the sleeve 4 in the second position. A locking ring 10 houses two brass shear pins 11 which are set to shear when the pressure in the tubular body 2 reaches a pre-determined value (for example 2000 psi). Once this pressure has been exceeded the shear pins break and the locking ring moves down to enable the barbs 8 to engage the protrusions 9.

In use the pressure flow valve is fitted to the end of the production tubing before the tubing is run into the metal casing of the well. Before the tubing is run into the metal casing the valve is in a neutral position as shown in Figure 2. As the tubing is lowered the fluid pressure in the annular space between the metal casing and the tubing (often referred to as the "annulus") is greater than the pressure in the tubing. This negative pressure differential causes the control means to move to the first position and open the flow ports 3 (as shown in Figure 3) permitting fluid to flow from the

annulus into the tubular body 2. This allows the production tubing to fill with fluid as it is lowered. Once the tubing has been lowered to a predetermined depth, the pressure difference between fluid in the annulus and fluid in the tubing equalises. To pressure test the production tubing the pressure of fluid in the tubing is increased above the pre-determined value. The ends of the fingers 7 abut against the ring 10. At the pre-determined pressure value the shear pins break and the barbs 8 of the fingers 7 engage the protrusions 9. The sleeve 4 is locked in the second position with the flow ports sealed (as shown in Figure 4). Once pressure testing has been completed the flow valve can be released from the end of the production tooling.

CLAIMS:

1. A pressure flow valve for controlling fluid flow in tubing which comprises:

a tubular body provided with at least one flow port;

fluid control means moveable relative to the tubular body from a first position in which fluid can flow into the tubular body via the flow port, to a second position in which the control means seals the flow port;

biasing means for moving the fluid flow control means towards the first position when the fluid pressure differential between fluid present in the tubular body and fluid outside the tubular body is negative, and moving the control means towards the second position when the pressure differential is positive and

locking means connected to the control means for retaining the control means in the second position once the flow port has been closed.

2. A valve according to claim 1, in which the fluid flow control means comprises a sleeve slidable relative to the tubular body between said first and said second position.

3. A valve according to claim 1 or 2, in which said biasing means comprises a resilient member and a pressure chamber, said pressure chamber being located intermediate the control means and the external surface of the tubular member, whereby a negative pressure differential can cause a reduction in the volume of said chamber and movement of the control means towards its first position, and so that the resilient member can urge the control means towards its second position when the pressure differential is positive.

4. A valve according to claim 3, in which the resilient member comprises a spring arranged to act directly on said sleeve.

5. A valve according to any one of claims 1 to 4, in which the locking means comprises a plurality of fingers extending from said sleeve, said fingers being engageable with one or more protrusions on said tubular body.

6. A valve according to any one of claims 1 to 4, in which the locking means comprises a plurality of fingers

extending from said sleeve, said fingers being engageable with one or more recesses provided in said tubular body.

7. A valve according to any one of the preceding claims, in which the locking means includes one or more shear pins arranged to permit locking of the control means only after the pressure inside the tubular body reaches a predetermined value.

8. A valve according to claim 7, in which said shear pins are housed in a ring upon which the ends of the fingers abut to lock the control means.

9. A valve according to any one of the preceding claims, in which said locking means is releasible, to permit the valve to be recessed remotely.

The Patent Office

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Claims searched:	1 to 9	**Date of search:**	12 September 1995

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): E1F (FAC; FLG, FLP); F2V (VV13, VW32, VW33)

Int Cl (Ed.6): E21B

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2272774 A	(French)	1
A	GB 2073287 A	(Halliburton Company)	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.